PATENT SPECIFICATION

407,148

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(Patent of Addition to No. 372,910: dated April 14, 1931.)

Complete Left: Nov. 7, 1933.

Complete Accepted: March 15, 1934.

PROVISIONAL SPECIFICATION.

Improvements in or relating to Pistons.

We, ERIC CESAR LEWIS, British Subject, of "Ramillies", 106, Marlborough Road, Coventry, in the County of Warwick, and KEITH ALFRED KNIGHT, British Subject, of 17, Queens Road, Coventry aforesaid, do hereby declare the nature of this invention to be as follows:—

This invention relates to certain improvements in and modifications of the piston described in the specification of our prior Patent No. 372,910

In the constructions described in the aforesaid specification the upper section of the socket of the ball and socket joint is necessarily in tension when the engine is running and one of the objects of the present invention is to provide an improved form or arrangement of said socket section that will enable it to resist the tensional stresses to which it is subjected in use.

The invention also includes certain modifications in the construction of the ball and of the head of the connecting rod the object of which is to reduce the production costs and to improve the efficiency of the joint as a whole.

According to this invention the tensional stresses imposed on the upper socket section of the ball and socket joint herein referred to, are adequately met either by means of a reinforced formation of the said section or by moving the plane of division between it and the lower section, in the direction of the piston crown relatively to the geometrical centre of the joint.

In the former case the said upper section is materially strengthened to resist tensional stresses by forming it with an external flange of a thickness considerably in excess of that of the wall of the section and in order to remove unnecessary weight this flange may be recessed around its outer face.

In the latter case the plane of division of the two sections of the socket may coincide with the upper surface of the flat head of the connecting rod, that is to say, nearer to the piston crown, thereby reducing the severity of the tensional stresses imposed on the upper section of the socket.

Instead of making the ball in three sections, as in the Parent Patent, it is now proposed to make it either in one piece, or in halves divided in a plane containing the axis of the connecting rod.

In the former case, the solid ball may be slotted through in a direction parallel with the axis of the engine crank shaft, to receive the flat head of the connecting rod the engagement of which with the ball is effected in a lateral direction through the open end of a slot cut in the ball at right angles to the first slot and of such form as to accommodate the neck of the rod below the head.

Alternatively, the head of the connecting rod may be made as a separate part and inserted in a slot cut through the ball in the direction of the axis of the engine crank shaft, the end of the connecting rod being subsequently inserted through a hole formed in the ball below and at right angles to said slot, and the head and rod secured together in any suitable manner, as by means of a screw thread engagement with a locking pin passed through the two parts.

Where the ball is made in halves, the flat face of each half is recessed to accommodate one half of the head and neck of the connecting rod the two halves of the ball being assembled about the head in a lateral direction and, if necessary, held together by means of a split spring ring taking a seating in a groove cut around the ball in a plane at right angles to the plane of division.

The former tongue and groove engagement between the ball and the head of the connecting rod can be dispensed with and relative translatory movement between the head and the ball be confined to a direction parallel with the engine crank shaft, by forming the said head with a flat surface at the sides adjacent the longitudinal walls of the slot in the ball.

Where the ball is made in one piece

[Price 1/-]

and slotted through to receive the head of the connecting rod the open ends of the slot may be closed in any suitable manner, as by means of a split spring ring introduced into a groove cut around the ball in the plane of the said slot. This will effectually prevent any tendency for the lubricating oil, in passing from the oil conduit in the connecting rod to the oil duct in the upper part of the ball, to be by-passed between the head and the slot in the ball.

The socket as a whole may be secured in its seating in the tubular extension of the piston crown by means of a sleeve or collar which instead of being made as an integral part of the bottom socket section, as in the previous construction, may be made separately therefrom and adapted to screw into the open end of said extension and to take a bearing by its inner end against a lip or flange on said bottom section.

Dated this 24th day of November, 1932.

T. FLETCHER WILSON, LL.B.
Fellow of the Chartered Institute of Patent Agents,
National Provincial Bank Chambers,
Coventry,
Agent for the Applicants.

COMPLETE SPECIFICATION.

Improvements in or relating to Pistons.

We, ERIC CRISP LEWIS, British Subject, of "Ramilles", 106, Marlborough Road, Coventry, in the County of Warwick, and KEITH ALFRED KNIGHT, British Subject, of 17, Queens Road, Coventry aforesaid, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to certain improvements in and modifications of the invention set forth in the specification of our prior Patent No. 372,910 and more particularly of the construction therein described in which the pivotal centre of the universal connection between the piston and connecting rod is fixed in relation to the piston and wherein provision is made for limited relative movement between the piston and the connecting rod in a direction parallel with the axis of the crank-shaft.

In the particular construction above referred to the ball is divided into two parts in a plane at right angles to the axis of the connecting rod, and the lower section is sub-divided to facilitate its assembly about the head of the connecting rod. In this case relative movement between the piston and the connecting rod in a direction parallel with the axis of the crank-shaft is provided for by forming the contacting faces of the upper ball section and the head of the connecting rod with a tongue and groove engagement.

The object of the present invention is to produce a piston and connecting rod assembly which is at once lighter, stronger, more efficient and less expensive than that described in the Parent Specification and hereinbefore referred to.

According to this invention relative bodily movement between the piston and the connecting rod at right angles to the cylinder axis is confined to a direction parallel with the axis of the crank-shaft by slotting the ball in that directon to receive the correspondingly formed head and/or neck of the connecting rod. The ball itself may either be formed in one piece or in halves divided in a plane containing the axes of the cylinder.

The invention also includes certain improvements in the socket for the ball, designed with a view to reduce or eliminate the risk of fracture under the severe stresses imposed upon it under service conditions.

In order that the invention may be clearly understood and readily carried into practical effect, reference is made in the following description to the accompanying drawing, in which,

Figure 1 is a sectional view of a piston illustrating the improved form of universal joint, the section being taken at right angles to the axis of the crank-shaft.

Figure 2 is a similar view at right angles thereto.

Figures 3, 4 and 5 are detail sectional views of the one-piece ball used in the joint shown in Figures 1 and 2, Figure 5 being a sectional plan view thereof.

Figure 6 is a general view of the head of the connecting rod.

Figure 7 illustrates a further modification of the universal joint in which the ball is made in halves adapted for assembly about the head of the connecting rod in a lateral direction.

Figures 8 and 9 are detail views illustrating alternative constructions of ball socket.

Throughout the drawing like parts are designated by similar reference characters.

Referring to the drawing, *a* represents the connecting rod and *b*, the piston which can be die-cast in any suitable alloy with an internal central tubular member b^1 to receive the socket *c* for the ball *d*.

As will be seen, the piston is of a lighter construction than that shown in the Parent Specification, the member b^1 springing from the lower part of the piston head instead of depending from the crown of the piston. Besides the reduction in weight which is obtained in this way there is less tendency for the said member, and hence the socket carried thereby, to get unduly hot.

In the construction shown in Figures 1 and 2 the socket *c* is divided into upper and lower sections and the inner end of the bore of the tubular member b^1 is formed with a shoulder b^2 which provides an abutment for an annular flange or series of projections c^1 formed around the upper section of the socket *c*. The said flange or projections c^1, besides providing a positive location for the socket, also in effect reinforces the upper section thereof against the considerable tensional stresses to which it is subject when the engine is running. Alternatively, these stresses may be reduced by dividing the socket in a plane which is offset from the geometrical centre of the joint in the direction of the piston crown, as shown in Figure 9, in which case the joint between the sections c, c^2 can be made oiltight by means of a flanged ring *e*. Or the said stresses can be avoided entirely by dividing the socket *c* in a plane containing the axis of the piston, as represented in Figure 8, the adjacent edges c^3 being flanged and abutting against each other.

The lower socket section c^2 may, as seen in Figures 1 and 2, be spigoted to receive the free edge of the upper section *c* and may be formed externally with a screw thread adapted to engage with the correspondingly screw-threaded outer end of the bore of the member b^1, in which case its outer end may be castellated or otherwise formed to facilitate the operation of screwing it into position in the member b^1. Instead of screwing the section c^2 into the member b^1 it may be secured in position therein by means of a sleeve nut f, as shown in Figures 8 and 9, the nut abutting against a flange c^4 on the section c^2 and engaging a screw thread in the bore of the member b^1.

In the construction shown in Figures 1 to 5, the ball *d* is made in one piece of metal or alloy and is slotted through at d^1 in a direction parallel with the axis of the engine crank-shaft to receive the flat head a^1 of the connecting rod *a* (Figure 6) the engagement of which with the ball is effected in a lateral direction through the open end of a slot d^2 (Figures 2—5) cut in the ball at right angles to the slot d^1 and of such form, as shown, to accommodate the neck of the rod below the head. The said head of the connecting rod is made a free sliding fit in the slot d^1 being formed with parallel flat sides a^2 so that relative translatory movement between the head and the ball is confined to a direction parallel with the axis of the engine crank-shaft. Alternatively, or in addition to the flat sides on the head, the adjacent part of the neck of the connecting rod may be formed with similar flat sides to co-operate with the sides of slot d^2. The open ends of the slot d^2 may be closed in any suitable manner, as by means of a split spring ring (not shown) introduced into a groove cut around the ball in the plane of the said slot. This will effectually prevent any tendency for the lubricating oil, in passing from the oil conduit a^3 in the head of the connecting rod to the oil-duct d^3 in the upper part of the ball to be bypassed between the head and the slot d^1 in the ball.

Where the ball *d* is made in halves, as shown in Figure 7, it is divided in a plane parallel with the axis of the engine crank-shaft and containing the axis of the connecting rod and the flat face of each half is recessed at d^4 to accommodate one half of the head a^1 and neck of the connecting rod *a* the two halves of the ball being assembled about the head in a lateral direction and, if necessary, held together by means of a split spring ring (not shown) taking a seating in a groove cut around the ball in a plane at right angles to the plane of division. Here also the formation of the recesses and of the head of the connecting rod is such that relative translatory movement between the head and ball can take place only in a direction parallel with the axis of the engine crank-shaft.

The head of the connecting rod may, if desired, be made as a separate part instead of being integral with the rod, in which case it can be inserted in a slot cut through the ball in the direction of the axis of the engine crank-shaft, the end of the connecting rod being inserted through a hole formed in the solid ball below and at right angles to said slot, and subsequently secured to the head in any suitable manner, as by means of a screw thread engagement with a locking pin passed through the two parts.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. The improvement or modification of the piston described in the Parent Patent herein referred to according to which relative bodily movement between the piston and the connecting rod at right angles to the cylinder axis is confined to a direction parallel with the axis of the engine crank-shaft by slotting the ball in that direction to receive the correspondingly formed head and/or neck of the connecting rod.

2. Pistons according to claim 1 in which the ball is either made in one piece with an open-ended slot below and in a plane at right angles to the plane of the first slot for the purpose of assembling the ball on the head of the connecting rod, or in halves divided in a plane containing the axis of the cylinder, the flat faces of the two halves being recessed to accommodate and allow for movement of the head of the connecting rod in a direction parallel with the axis of the engine crank-shaft.

3. In pistons according to either of the preceding claims, forming the upper socket section for the ball and socket with an external flange or series of projections adapted to abut against a shoulder in the tubular member of the piston.

4. In pistons according to claim 1, 2, or 3 in which the socket for the ball is divided in a plane which is off-set from the geometrical centre of the joint in the direction of the piston crown.

5. Pistons according to claim 1, 2 or 3, in which the socket for the ball is divided in a plane containing the axis of the piston.

6. Pistons according to any of the preceding claims in which the sections of the divided socket for the ball are secured in position in the piston by means of a sleeve nut, or its equivalent, screwing into the end of the tubular member and abutting against a flange formed around one or both of said socket sections.

7. Pistons according to any of the preceding claims in which the joint between the sections of the socket is sealed by means of a ring arranged around the socket in the plane of division.

8. Pistons according to claim 1 in which the head of the connecting rod is made as a separate part and adapted to be inserted in the slot in the ball, the end of the connecting rod being inserted through a hole formed in the ball below and at right angles to said slot and subsequently secured to the head.

9. The improvements in or modifications of the piston set forth in the Parent Patent substantially as herein described and as shown in the accompanying drawing.

Dated this 6th day of November, 1933.

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Coventry,
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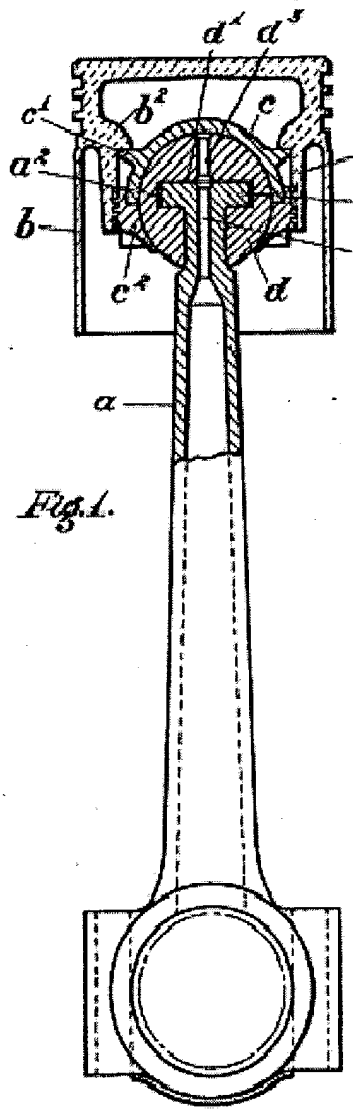

Fig. 1.

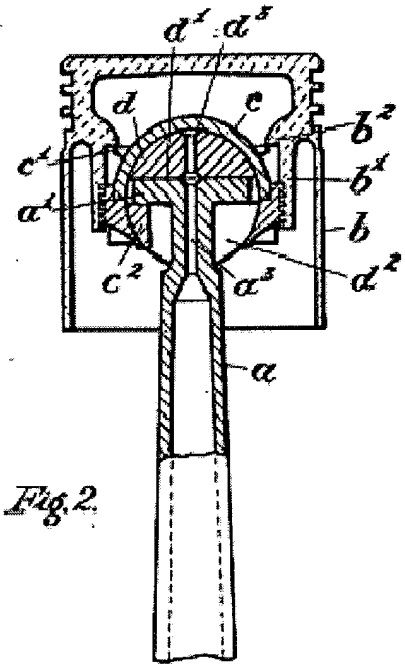

Fig. 2.

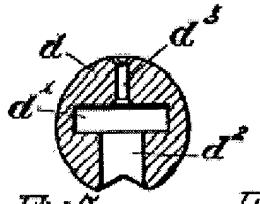

Fig. 3.

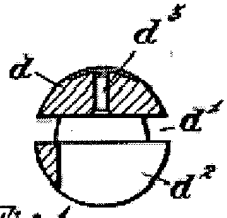

Fig. 4.

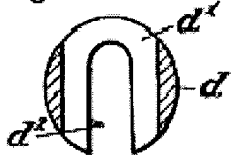

Fig. 5.

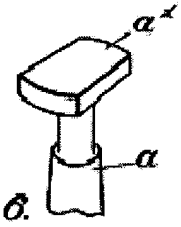

Fig. 6.

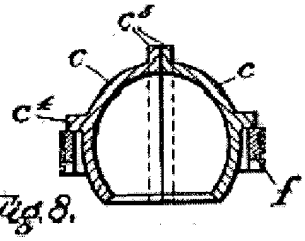

Fig. 8.

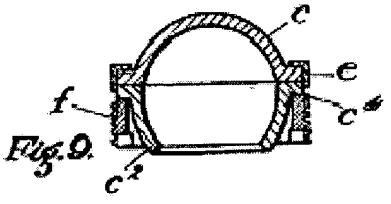

Fig. 9.

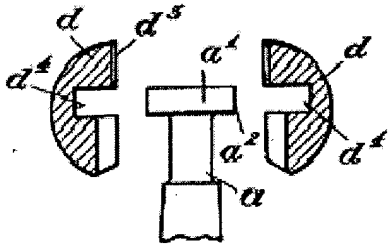

Fig. 7.

Malby & Sons, Photo Litho.